# Upper Upper Miocene Progradational (UM3 P1) Play

## *Cristellaria* "K" through *Robulus* "E" biozones

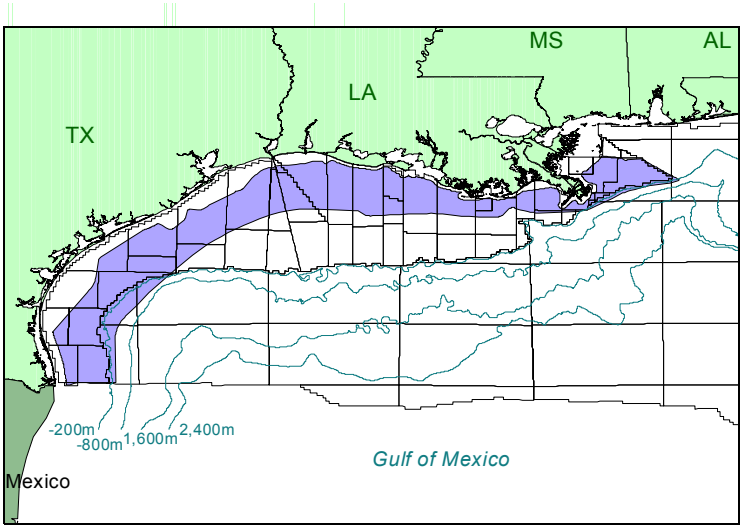


*Figure 1. Play location.*

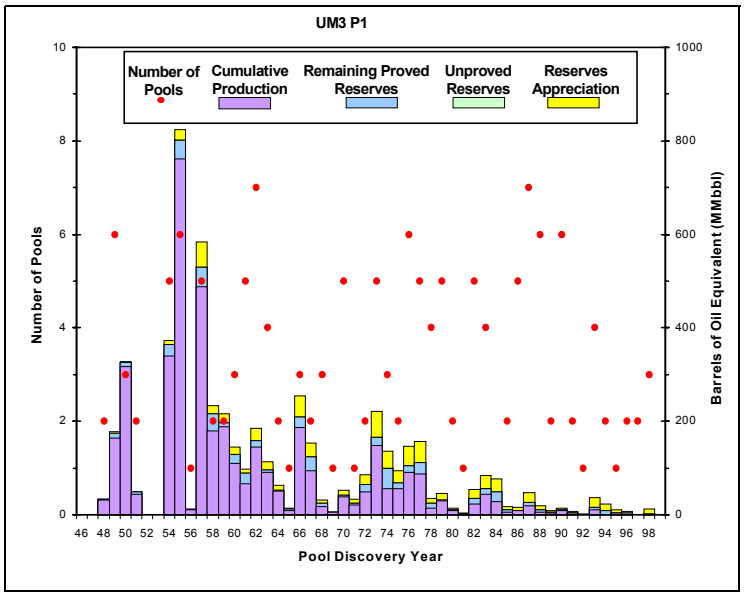


*Figure 2. Exploration history graph showing reserves addition and number of pool discoveries by year.*

| UM3 P1 Play<br>174 Pools 1067 Sands | Minimum | Mean | Maximum |
|---|---|---|---|
| Water depth (feet) | 9 | 73 | 339 |
| Subsea depth (feet) | 1725 | 8505 | 16846 |
| Number of sands per pool | 1 | 6 | 44 |
| Porosity | 19% | 29% | 37% |
| Water saturation | 16% | 28% | 55% |

*Table 1. Pool attributes. Values are volume-weighted averages of individual reservoir attributes.*

## Play Description

The Upper Upper Miocene Progradational (UM3 P1) play is the second largest play in the Gulf of Mexico Region on the basis of BOE total reserves and BOE cumulative production. The play has also produced the most oil of any play in the Gulf of Mexico Region. The UM3 P1 play occurs within the *Cristellaria* "K," *Bigenerina* "A," and *Robulus* "E" biozones and extends from the South Padre Island Area offshore Texas to the Main Pass Area east of the present-day Mississippi River Delta (figure 1).

Updip in the Texas offshore, the play grades into the deposits of the Upper Upper Miocene Aggradational (UM3 A1) play, while in Louisiana, the UM3 P1 play continues onshore. The play continues to the southwest into Texas State and Mexican national waters. To the northeast, the play is limited by the deposits of the Upper Upper Miocene Aggradational/Progradational (UM3 AP1) play overlying the Cretaceous carbonate shelf. Downdip and to the east, the UM3 P1 play grades into the deposits of the Upper Upper Miocene Fan 1 (UM3 F1) play.

## Play Characteristics

The 29 reservoir sands offshore Texas were deposited mostly in distal portions of prograding delta lobes or offshore bars. Many of these sands are thin and poorly developed because of a low influx of clastics into the offshore Texas area during UM3 time. Consequently, many UM3 progradational sands in the Texas offshore have not been prolific reservoirs. In fact, in the South Padre Island and Mustang Island Areas, the progradational facies is present but not productive.

The 1,038 reservoir sands of the offshore Louisiana area were deposited in delta fringes, channel/

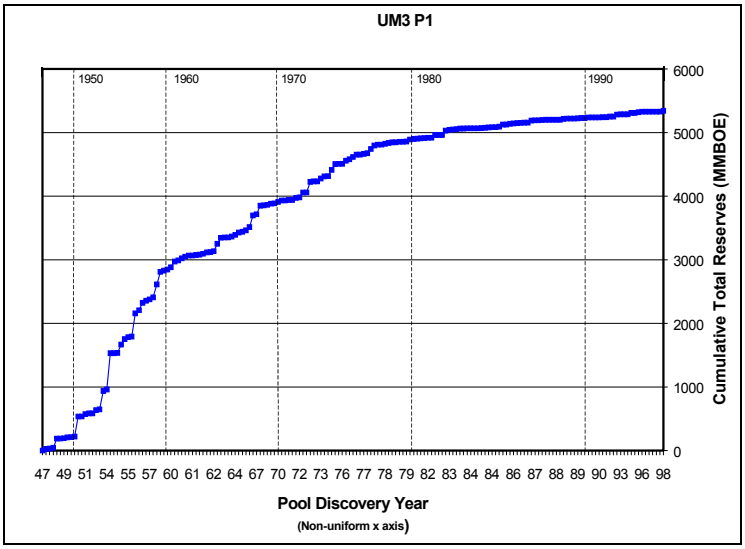


*Figure 3. Plot of pools showing cumulative reserves by discovery order. Note the non-uniform x axis.*

| UM3 P1 Play<br>Marginal Probability = 1.00 | Number of Pools | Oil (Bbbl) | Gas (Tcf) | BOE (Bbbl) |
|---|---|---|---|---|
| **Reserves** | | | | |
| Original proved | 172 | 2.421 | 12.207 | 4.593 |
| Cumulative production | -- | 2.183 | 10.525 | 4.056 |
| Remaining proved | -- | 0.238 | 1.682 | 0.537 |
| Unproved | 2 | <0.001 | 0.002 | <0.001 |
| Appreciation (P & U) | -- | 0.299 | 2.517 | 0.747 |
| **Undiscovered Conventionally Recoverable Resources** | | | | |
| 95th percentile | -- | 0.054 | 0.734 | 0.195 |
| Mean | 35 | 0.079 | 0.885 | 0.236 |
| 5th percentile | -- | 0.107 | 1.046 | 0.281 |
| **Total Endowment** | | | | |
| 95th percentile | -- | 2.774 | 15.460 | 5.536 |
| Mean | 209 | 2.799 | 15.611 | 5.577 |
| 5th percentile | -- | 2.827 | 15.772 | 5.622 |

*Table 2. Assessment results for reserves, undiscovered conventionally recoverable resources, and total endowment.*

levee complexes, and distributary mouth bars. Because the central offshore Louisiana area was the locus of the main UM3 deltaic depocenter, these sands are thick and well developed. The thickest sand-dominated intervals probably represent stacked facies of multiple episodes of delta-lobe switching and progradation.

The majority of the fields in this play are structurally associated with normal faults and salt diapirs with hydrocarbons trapped on diapir flanks or in sediments draped over diapir tops. Other fields are structurally associated with growth fault anticlines, while some fields contain hydrocarbon accumulations trapped by permeability barriers, updip pinchouts, or facies changes. Seals are provided by the juxtaposition of reservoir sands with shales and salt, either structurally (e.g., faulting, diapirism) or stratigraphically (e.g., lateral shale-outs, overlying shales).

## Discoveries

The UM3 P1 mixed oil and gas play contains total reserves of 2.720 Bbo and 14.726 Tcfg (5.341 BBOE), of which 2.183 Bbo and 10.525 Tcfg (4.056 BBOE) have been produced. The play contains 1,067 producible sands in 174 pools (table 1; refer to the Methodology section for a discussion of reservoirs, sands, and pools). The first reserves in the play were discovered in the Ship Shoal 72 field in 1948 (figure 2). Since then pool discoveries have averaged three to four per year. The maximum yearly total reserves of 824 MMBOE were added in 1955 when six pools were discovered, including the largest pool in the play, the Bay Marchand 2 field with 572 MMBOE in total reserves (figures 2 and 3). Ninety-nine percent of the play's cumulative production and ninety-seven percent of the play's total reserves are in pools discovered before 1990. The most recent discoveries, prior to this study's cutoff date of January 1, 1999, were in 1998.

The 174 discovered pools contain 2,766 reservoirs, of which

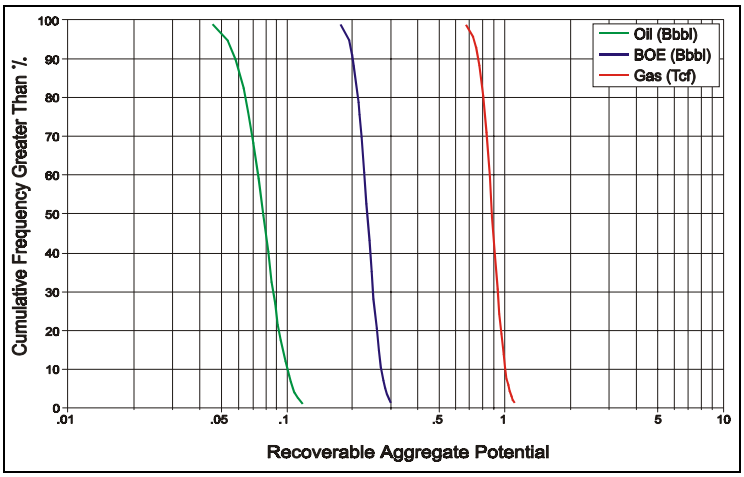


*Figure 4. Cumulative probability distribution for undiscovered conventionally recoverable resources.*

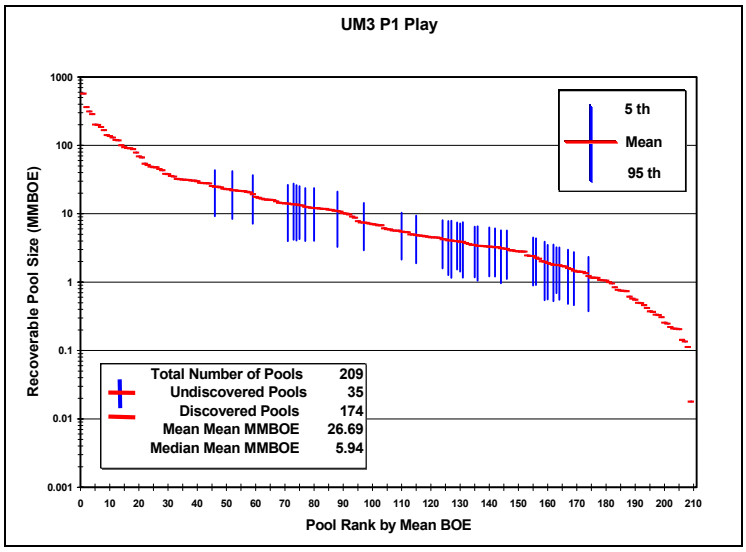


*Figure 5. Pool rank plot showing the number of discovered pools (red lines) and the number of pools forecast as remaining to be discovered (blue bars).*

1,194 are nonassociated gas, 1,289 are undersaturated oil, and 283 are saturated oil. Cumulative production has consisted of 54 percent oil and 46 percent gas.

The Upper Upper Miocene Progradational (UM3 P1) play is the second largest play in the Gulf of Mexico Region on the basis of BOE total reserves (8 percent of BOE total reserves in the Region) and BOE cumulative production (12 percent of the total in the Region). It has also produced the most oil of any play in the Gulf of Mexico Region (20 percent of oil production). The UM3 P1 play is the second largest progradational play in the Gulf of Mexico Region in total endowment, total reserves, and cumulative production.

## Assessment Results

The marginal probability of hydrocarbons for the UM3 P1 play is 1.00. This play is the third largest in the Gulf of Mexico on the basis of a mean total endowment of 2.799 Bbo and 15.611 Tcfg (5.577 BBOE) (table 2). Seventy-three percent of this BOE mean total endowment has been produced.

Assessment results indicate that undiscovered conventionally recoverable resources (UCRR) have a range of 0.054 to 0.107 Bbo and 0.734 to 1.046 Tcfg at the 95th and 5th percentiles, respectively (figure 4). Mean UCRR are estimated at 0.079 Bbo and 0.885 Tcfg (0.236 BBOE). These undiscovered resources might occur in as many as 35 pools. The largest undiscovered pool, with a mean size of 25 MMBOE, is forecast as the 46th largest pool in the play (figure 5). The forecast places the next four largest undiscovered pools in positions 52, 59, 71, and 73 on the pool rank plot. For all the undiscovered pools in the UM3 P1 play, the mean mean size is 7 MMBOE, which is significantly smaller than the 31 MMBOE mean size of the discovered pools. The mean mean size for all pools, including both discovered and undiscov-

ered, is 27 MMBOE.

The UM3 P1 is a supermature play with UCRR contributing only 4 percent to the UM3 P1 play's total endowment. In the Texas offshore, limited potential may lie downdip of the discovered fields where wells have not penetrated deeply enough to reach the UM3 P1 play.